

The invention relates to an apparatus for cutting film webs having intrinsically flexible circular cutters, which are fitted interchangeably in a hub flange of a cutter shaft and are axially set with respect to likewise circular keyway cutters, which are mounted on a keyway cutter shaft, the disk cutters being clamped by means of intermediate rings on the disk cutter shaft, in which arrangement each of the cylindrical intermediate rings has on one of its outer faces a radial circular-cylindrical groove in which one or more spring elements engage, the point of application of which lies within the radial diameter of the intermediate ring, so that, in the clamped state of the disk cutter shaft, the disk cutter lies fully flat and is axially deformed only upon axial setting by the keyway cutter.

The following basic forms are known to date from the prior art for the construction of the disk cutter shaft

1. The disk cutter is pressed by a spring against the keyway cutter.

Figure 1 shows the principle of this arrangement. Corresponding apparatuses are known from German Patents 305,586 and 2,405,849. In the case of this known arrangement, the disk cutter (1) is seated on intermediate rings (3) of the disk cutter shaft and is pressed by a spring (4), for example a cup spring, initially against the side face of the adjacent intermediate ring. Since the spring (4) acts on the disk cutter (2) at a diameter which is greater than the diameter of the bearing face of the disk cutter on the intermediate ring, the usually thin disk cutter (for example 0.5 mm thick) is deformed by the spring (1' - in Figure 1). This arrangement has the following disadvantages

- Inhomogeneities in the circumferential direction of the cup springs cause eccentric running of the disk cutters
- Axial displacement brings the disk cutters into

contact with the keyway cutters, the spring (4) being intended to generate the pressing force between disk cutter and keyway cutter. Due to the deformation of the disk cutter "toward the keyway cutter", caused by the spring, an undesired touching of the edges of the disk cutter and of the keyway cutter is brought about. This results in increased cutter wear and consequently poor cutting quality

- A further disadvantage arises from the fact that usually a large number of disk cutters and a corresponding number of keyway cutters are fitted on shafts in order to cut wide webs into narrow strips. Since the cup springs normally have certain tolerances in their rigidity, the extent of this undesired deformation of the disk cutters varies, which in turn brings about deviations in the spacing on the disk cutter shaft, that is to say the distance from cutter to cutter. The thickness of the disk cutters has in itself no effect on the shaft tolerances; the spacing accuracy of the disk cutter shaft and the accumulated spacing deviation of the cutter shaft (overall length) is initially determined only by the thickness of the intermediate rings. However, by the deformation of the disk cutters owing to the spring force, again deviations from the theoretical shaft spacing occur.

In the case of this arrangement it is advantageous that the disk cutters can be simply disassembled from the shaft and can thus be reground while all clamped together. As a result, short grinding times and good grinding finishes can be achieved.

In DE 36 42 005, a disk cutter arrangement is described in which the disk cutters are deformed frustoconically "toward the keyway cutter" by a

corresponding shaping of the intermediate rings or by the force of the cup springs. This is intended to bring about favorable contact between disk cutter and keyway cutter. However, according to the investigations of the applicant, in this case touching of the edges of the cutters occurs, as can also be seen from Figure 1.

In DE 968 269, a circular cutter is described which comprises a thin annular disk which is held on an annular supporting element. The circular cutter is slightly conically deformed. The pressing of the circular cutter against the counter-cutter is performed resiliently by a helical spring. Due to the additional use of a supporting ring, the cutter system described is very complicated in construction.

The document NL-A 8 503 497 describes a longitudinal cutting apparatus in which two circular cutters, biased by springs, on both sides act in each case on the edge of the opposite keyway cutter. The spring biasing is effected by a clamping piece, provided with a radial groove, being arranged on one side of the disk cutter, there being inserted in the groove a spring element which presses the circular cutter against the edge of the keyway cutter via a spacer.

DE-A 24 37 860 describes a circular cutter holder, in which a tension spring is arranged between a hub collar of the holder hub and the back of the circular cutter, which is at a distance from the said hub collar, and displaces the rigid circular cutter, provided with a torsion-preventing element, axially toward the opposite cutter.

2. The disk cutters are clamped rigidly between spacer rings.

Figure 2 shows the principle of this arrangement. This arrangement is known from US Patents 4,330,092 and 4,428,265. In the case of these arrangements, the disk cutters (1) are firmly clamped between spacer rings (9) and serve themselves as a resilient element. Since the disk cutters are produced with close tolerances and consist of high-grade materials, for example hard metal, the individual "springs" are very uniform. As Figure 2 shows, in the case of this arrangement a deformation of the disk cutters takes place in such a way that the edge of the disk cutters does not touch the edge of the keyway cutters, thereby avoiding damage to the edge of the disk cutters, which is favorable for cutting quality.

This arrangement has the following disadvantages

- in comparison with the arrangement according to Figure 1, the tolerances are influenced by twice as many parts (spacer rings and disk cutters), resulting in increased assembly and adaptation effort. In addition, the thickness of the disk cutters must be chosen with a tolerance of about 1 μ m, making the disk cutters very expensive.
- If regrinding of the disk cutters is performed on the disk cutter shaft, considerable grinding time is required and problems arise with the grinding finish, since the thin disk cutters can flex during grinding. If, on the other hand, regrinding is performed with the cutters disassembled and together as a group, considerable assembly effort results on account of the requirement for high accuracy.

Therefore, it is an object of the present invention to find a cutting apparatus of the generic type mentioned at the beginning with which

- a deformation of the disk cutters "toward the keyway cutter", unfavorable for cutter wear, is avoided
- the disk cutters are fixed exactly and with little

vibration

- there are as few parts as possible determining accuracy
 - simple assembly and disassembly of the disk cutter
- 5 shaft is possible and consequently regrinding of the disk cutters can be performed in the disassembled state.

We have found that this object is achieved with a cutting apparatus such as that described in the claim
10 1 [sic], the principle of which is represented in Figure 3. The invention is explained in further detail below. In the drawings,

Figures 1 and 2 show known cutting apparatuses

Figure 3 shows a specific embodiment of the
15 present invention.

A preferred form can be seen from Figure 3. The intermediate ring (33) has adjacent to its one side face a radially encircling groove (21), the depth of which in the radial direction reaches approximately as far as the
20 inner bore of the disk cutter (1). In this way, a thin flexible spring ring (18) is produced, the outer open end of which is bent away and, with its side face (19), presses the disk cutter (1) against the next-following intermediate ring (33), the outside of the open end of
25 the spring ring terminating flush with the radius of the intermediate ring (33). To improve the flexible effect, the spring ring has a recess (20) between outer end and inner end on its side facing the disk cutter. This apparatus offers advantages, namely narrow construction,
30 avoidance of many parts and is also suitable for cutting narrow strips.

[lacuna]

Apparatus for cutting film webs having intrinsically flexible circular cutters, which are fitted interchangeably in the hub flange of a cutter shaft and
5 are axially set with respect to likewise circular keyway cutters, which are clamped on a keyway cutter shaft, the disk cutters being clamped by means of intermediate rings on the disk cutter shaft, in which arrangement each of the cylindrical intermediate rings has on one of its
10 outer faces a radial circular-cylindrical groove, the disk cutters being prestressed by means of spring elements, the point of application of which lies within the radial diameter of the intermediate ring (33), so that, in the clamped state of the disk cutter shaft, the
15 disk cutter lies fully flat and is axially deformed only upon axial setting by the keyway cutter, wherein each intermediate ring (33) mounted on the disk cutter shaft (6) has adjacent to its one cylindrical outer face a radially extending groove (21), the depth of which in the
20 radial direction reaches approximately as far as the inner bore of the disk cutter (1) and wherein the outer open end of the thin spring ring (18) thus produced is bent away in the direction of the next intermediate ring (33) and, with its side face (19), presses the disk
25 cutter against the next-following intermediate ring, wherein the spring ring has on its side facing the disk cutter a recess (20) between outer end and inner end and wherein the spring force of the spring elements (18) [sic] is so great that, upon axial setting of the keyway
30 cutter (2), the disk cutter (1) is not deformed within the region in which it bears against the intermediate ring (33).